SECTION

III

Future Conditions and Directions

Preface

Sections I and II have described water resource conditions within the Prescott Active Management Area (AMA) and the regulatory programs designed to cause efficient use of groundwater and increasing amounts of renewable water supplies to be used. The Arizona Department of Water Resources' (Department) regulatory program for the third management period described in Section II represents the midpoint in our overall management strategy to implement water management programs which ultimately will lead to the achievement of the AMA's management goal by the year 2025.

This section, Section III, describes projected future conditions within the Prescott AMA, as well as the directions the Department proposes to take in developing water management programs during the third management period.

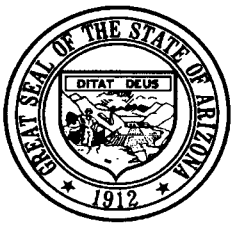
Alternative future water supply and demand conditions are described in Chapter 11. The Department's supply and demand conditions, also known as "water budgets," are designed to illustrate a range of supply and demand possibilities for consideration as we develop our management programs. Both Prescott AMA scenarios exhibit significant overdraft conditions; one more severe than the other. Chapter 11 projects continued overdraft scenarios even under optimistic conditions, indicating that mid-course changes in direction may be necessary if we are to achieve safe-yield by 2025.

Chapter 12 describes some options for the future, looking towards ultimately achieving the AMA management goal through increasingly stringent requirements for the conservation of groundwater along with the augmentation of water supplies. Chapter 12 summarizes existing water management problems, identifies the obstacles to safe-yield, and describes the actions the Department expects to take to remove these obstacles during the Third Management Period and beyond.

CHAPTER

11

Water Budgets and Projections



11.1 INTRODUCTION

The Arizona Department of Water Resources (Department) uses detailed planning water budgets to evaluate the balance of water demands and water supplies and to help determine progress toward meeting the Prescott Active Management Area (AMA) safe-yield goal. Water demand and supply projections and water budget scenarios are prepared based on many assumptions. Two water budget scenarios, a baseline scenario and a conservation and augmentation scenario, were prepared and are discussed in this chapter. A water balance is tabulated for these budgets in five-year increments through the year 2025. In addition, a sensitivity analysis was performed on selected variables in the water budget to determine the relative impact of these variables on groundwater overdraft in the year 2025.

Water is a physical resource, and as such can be tracked and understood in purely physical terms. However, water management is becoming increasingly tied to legal accounting mechanisms for water rather than only through the use of hydrologic water budgets. Using legal mechanisms for water accounting addresses needs such as stepping up the pace of renewable supply use and accounting for short and long-term storage of recharged water. However, problems can arise because of inconsistencies between physical reality and legal accounting.

Stored water that has been stored or saved underground pursuant to a Water Storage Permit is generally not accounted for as a supply in a water budget using a legal accounting format, because the owner of a water storage permit to such water is the only entity which has a legal right to recover waters derived from this permit. As a result of this legal structure, stored water cannot be considered available until it is recovered for the purpose of determining an AMA-wide balance between water supplies and demands.

Although a hydrologic water budget was provided in Table 3-11 to demonstrate existing water conditions, the planning water budgets contained in this chapter included only water supplies which could be legally used to determine safe-yield within an AMA. Consequently, water storage credits derived from the recharge of effluent were excluded from the water budgets presented in this chapter, because the owner of the stored water has the sole legal right to recover this water source.

11.2 WATER BUDGET SCENARIOS

Two water budget scenarios were selected from numerous scenarios examined by the Department to illustrate possible water demand and supply scenarios in the Prescott AMA. The water budget scenarios are as follows:

- **Baseline Scenario**: Assumes that current municipal, agricultural, and industrial water use practices continue through the year 2025. Municipal water use is assumed to be entirely reliant on groundwater sources that are allocated or have been recovered pursuant to water storage permits. A baseline rate of effluent use is assumed.

- **Conservation and Augmentation Scenario**: Assumes that municipal demand levels are reduced to meet Third Management Plan conservation requirements by 2010 and these reduced rates continue through the year 2025. Expanded use of effluent and the addition of other renewable supplies are projected.

The following variables and assumptions stay constant for all water budget scenarios:

- The AMA population projections are based on Arizona Department of Economic Security (ADES) projections published in 1997.

- The baseline estimate for municipal and industrial water demand is derived from 1996 annual use.

- A baseline estimate for the agricultural sector was developed by averaging annual groundwater use from 1990 to 1996. Effluent use will increase to 1,500 acre-feet per year under the City of Prescott/CVID agreement, and CVID surface water deliveries will cease. Surface water use from Del Rio Springs (LIC) will remain constant at 900 acre-feet per year.

- Active agricultural acreage in the Prescott AMA will be reduced from approximately 1,700 acres to about 950 acres by 2010 and continue at that level through the year 2025. The reduction is in anticipation of the transfer of lands in support of municipal development and as a result of the recent agreement between the City of Prescott and the CVID. No further declines are projected beyond 2010 since this is the volume of farming projected to remain viable on a long-term basis within the AMA.

- Industrial water demand increases are tied to population growth rates projected for the AMA.

- The supply of effluent is tied to population growth within the service areas of the two large water providers (City of Prescott and Prescott Valley Water District).

Specific demand and supply assumptions used in these scenarios are described in the following sections.

11.3 OVERVIEW OF SECTOR DEMAND

Water use in the Prescott AMA is divided into municipal, agricultural, and industrial sectors for analysis and management purpose. Estimated groundwater withdrawals in the Prescott AMA from exempt wells are not managed by the Department, but are tracked in the water budget as a separate demand component. The methodology for developing exempt well demand projections is described in Chapter 5 and in section 11.3.2 of this chapter.

Average water use from the year 1992 through 1995 was used to develop a projection baseline for municipal demand estimates. This projection baseline should not to be confused with the actual baseline demand estimates included in each water budget scenario for this chapter.

For a reference, Table 11-1 displays the 1992-1995 average water use for each regulated sector.

11.3.1 Agricultural Demand Assumptions

Agricultural water demand is a function of the total acreage which can be legally irrigated, the land actually cultivated in a given year (the crop-acreage ratio), the efficiency of water use, the average consumptive use of crops, and any lost and unaccounted for water. More information on agricultural water use characteristics and projections is contained in chapters 3 and 4.

Total agricultural water use by the agricultural sector was 14,088 acre-feet in 1985, 6,932 acre-feet in 1990, and 9,217 acre-feet in 1995. Since 1990, surface water as a proportion of overall agricultural water use fluctuated from 900 acre-feet per year to over 4,500 acre-feet, while effluent use varied up to 611 acre-feet.

Groundwater use between 1990 and 1996 ranged from a low of 4,613 acre-feet in 1992, to a high of 6,629 in 1996, although the pattern reflects numerous fluctuations as revealed in Table 3-1.

TABLE 11-1
AVERAGE WATER USE BY SECTOR 1992-1995
PRESCOTT ACTIVE MANAGEMENT AREA

Sector	Source of Water Supply	Use of Water Supply	1992-1995 Average Use and Percent
Municipal	Cities, towns, private water companies	Non-irrigation uses including groundwater and effluent; includes non-residential uses such as turf, commercial/retail, and industrial facilities as well as residential uses served by water providers	10,404 acre-feet 49 %
Agricultural	Irrigation Grandfathered Water Rights; CVID waters	Cultivation including groundwater, surface water, and effluent	8,976 acre-feet 43 %
Industrial	Type I or Type II non-irrigation Grandfathered Water Rights; groundwater withdrawal permits	Industrial, commercial, and domestic uses including turf demand served by the facility's own well	508 acre-feet 2 %
Exempt Wells	Unregulated wells that pump less than 35 gallons per minute	Domestic uses and agricultural irrigation of less than 2 acres	1,257 acre-feet 6 %

Of the 6,521 acres of land with Irrigation Grandfathered Right (IGFR) allotments in 1985, approximately 5,300 acres currently remain. Of the estimated 5,300 irrigable acres, roughly 1,700 acres were cultivated during 1995. This figure has remained generally constant, as depicted in Table 3-4. Based on an informal survey by the Prescott AMA office, the number of IGFR acres expected to remain in operation by 2010 is projected to decrease to about 950 acres. This decline is anticipated to result from the conversion of agricultural lands to support municipal growth. Further declines in IGFR acres are not projected beyond 2010, as some farms are assumed to remain in operation as hobby farms supporting new development primarily in the Upper Agua Fria Subbasin.

The CVID can deliver surface water (and effluent) to 2,458 decreed acres in the Little Chino Subbasin. Availability of surface water, stored at Watson and Willow lakes, is dependent on annual precipitation patterns and cannot be ensured on an annual basis at any given volume. Canal losses were assigned at 50 percent for all deliveries of surface water and effluent to the CVID during the period of record from 1990-1996 due to lack of lining of the main canal. Future agricultural water demands in the CVID, beginning in 1999, will be met using recovered effluent. This water will be delivered from wells located in the CVID. No further surface water deliveries from the lakes through the canal are anticipated. Approximately 300 acres in the CVID are expected to remain in production until the year 2005. It is anticipated that after the year 2025, no irrigated acreage will remain in the CVID. Farming efficiencies are assumed to remain at the Second Management Plan level of 75 percent.

Although the City of Prescott has agreed to make recovered effluent available for use on irrigated acreage in the CVID until 2020, it is anticipated that no irrigated acreage will remain in the CVID after the year 2005. The City of Prescott/CVID agreement requires the City of Prescott to make 1,500 acre-feet of recovered effluent available as first-use water by the CVID annually. Groundwater can be used to

supplement those lands in the CVID, having IGFRs, until year 2005. The maximum amount of groundwater which can be used is equal to the highest amount pumped in a single year, consistent with conservation requirements, or 25 percent of the annual groundwater allotment.

11.3.2 Municipal Demand Assumptions

Municipal demand is composed of both potable and nonpotable water use by AMA water providers and municipal turf facilities using effluent. Water use associated with exempt wells, which are primarily used for domestic purposes, was included in the water budgets under a separate demand category due to the unregulated status of exempt wells. Population and per capita water consumption, made up of interior and exterior residential use and non-residential use by commercial, industrial, institutional, parks, and golf courses, are the primary factors that influence municipal demand.

11.3.2.1 Population

The ADES regularly prepares population projections statewide. These projections are disaggregated by counties for local jurisdictions. In addition, the Department disaggregates ADES projections by subbasin and AMA statewide. The sum of all county projections for local jurisdictions must add up to the ADES total population projection for the state. Similarly, the Department's disaggregation to all subbasins in the state must add up to the ADES total for the state. This is called "benching" to the total.

The county as well as the Department's numbers are reviewed and approved through the ADES Population Technical Advisory Committee (POPTAC). Arizona state agencies are required through Executive Order 95-10 to utilize the ADES population estimates unless a more accurate, generally accepted methodology is prepared.

Commonly, municipal water provider service areas do not correspond precisely to the incorporated boundary of a city or town where water is served. In order to develop the most accurate service area population possible, the Department overlays the boundaries of the municipal water provider service areas onto the maps that ADES uses to project population. The ADES maps often follow the same tracts and blocks that are used to tally population by the United States Census Bureau.

In preparing the Third Management Plan, ADES projections prepared and approved in 1997 were used in all AMAs. The Department used the assumptions below to generate substitute population projections for the Prescott AMA. Both water budget scenarios were assigned the same set of population assumptions detailed below.

- The Prescott service area projection is calculated using the same percent per year growth rates that were used by ADES to calculate the Prescott City limits projections.

- The Prescott Valley Water District service area projection was calculated by subtracting the Prescott, small provider, and exempt well population from the total ADES population projection for the AMA.

- The total small provider population was calculated by multiplying the ADES population projection for the AMA by 0.05 (5 percent of the AMA population) through the year 2025. Small providers have historically made up about 5 percent of the AMA population.

- The exempt well population was calculated by multiplying the ADES population projection for the AMA by 0.18 (18 percent of the AMA population) through the year 2025. Exempt well population has historically made up about 18 percent of the AMA population.

Population projections are thus used to project demand in water budgets that follow in this chapter. It should be noted, however, that since the population never corresponds exactly to the projections, actual demand figures will vary. These figures are merely to provide some estimate of demand at current and more conserving use rates, using the official population projections as prepared by ADES, to develop future demand scenarios for planning purposes. As new projections are developed and approved, these budgets will change.

Executive Order 95-10 requires state agencies to utilize the population projections approved by ADES. Since the population projections are updated only once every five years, changes in rates of growth within the five-year time span may render the projections quickly out of date. To ensure the most accurate projections possible, all areas within the AMA must closely track and maintain good records of building completions or certificates of occupancy, since this is the main source of data used by ADES to develop population projections for the state.

11.3.2.2 Water Use

For the Third Management Plan municipal demand projections, water use from the years 1992 through 1995 was averaged to develop a "base year" from which to calculate water conservation potential. An average was used to avoid selecting a single base year that may not have been representative of typical water use within the sector.

11.3.2.2.1 Base Scenario

Municipal water use was analyzed for the period of 1992 through 1995 for the AMA's large providers and for small providers as a whole. The 1992 through 1995 average gallons per capita per day (GPCD) rates for the large providers and for the small providers as a whole were used to project demand for the base scenario.

The direct use of effluent is projected to increase only in conjunction with the addition of new golf courses within the City of Prescott service area. It is assumed that the Prescott Valley wastewater treatment facility will continue to discharge effluent into the Agua Fria River.

The City of Prescott and the Town of Prescott Valley will accumulate Recovered Effluent Credits. The City of Prescott has been recharging treated effluent at their recharge facility since 1988 and has had an underground storage and recovery permit for treated effluent since 1994.

11.3.2.2.2 Conservation and Augmentation Scenario

For large providers in the conservation scenario, the existing residential sector as of the year 2000 was assumed to maintain its Third Management Plan final existing residential GPCD component requirement through the year 2025 (see Chapter 5). New population added between 2000 and 2025 was assumed to continue to come in at the model water use rates for new single family and multifamily homes established in Chapter 5 for the Municipal Conservation Program. The non-residential GPCD was assumed to remain constant at the non-residential GPCD component requirement as stipulated in the Third Management Plan. Lost water was maintained at the 1992-1995 average percent, up to 10 percent. For small providers, the 1992-1995 average GPCD rate was used to project water use through the year 2025, with no reduction.

The direct use of effluent is expanded in this scenario to include all projected golf courses associated with the Prescott Valley Water District service area and in the vicinity of Prescott Valley. Effluent is anticipated to be supplied by the Prescott Valley wastewater treatment facility to these added turf water users. The Town of Prescott Valley is currently engaged in efforts to locate a suitable recharge facility. When they have located an acceptable site they will begin efforts to acquire an underground storage and

recovery permit. This will enable the Town to begin accumulation of credits and to develop an effluent management plan.

11.3.3 Industrial Demand Assumptions

Industrial demand includes all groundwater pumped pursuant to non-irrigation grandfathered rights and withdrawal permits. More information on industrial water use characteristics, future trends, and specific conservation requirements for each industrial subsector is contained in chapters 3 and 6.

Industrial demand encompasses all water users served by Type 1 or Type 2 non-irrigation rights and groundwater withdrawal permits. For water budget purposes, industrial demand components were sorted into turf facilities and non-turf facilities. The ratio of baseline industrial demand and baseline AMA population was adopted as a standard for prorating future demand estimates measured against projected population during each time interval. Both scenarios utilized this methodology.

A vast majority of industrial demand in the Prescott AMA has historically been attributed to turf facilities. Because the scope of industrial demand is relatively minor in relation to municipal or agricultural demand and the City of Prescott delivers effluent to the largest turf facility in the AMA (Antelope Hills Golf Course), industrial projections are grouped into one lump sum projection. The key difference between the two scenarios is whether one or both large water providers will deliver effluent to industrial water users in the future.

The Baseline Scenario assumed that only new industrial users in the City of Prescott's service area will receive effluent to support their water demands. The Conservation and Augmentation Scenario assumed that all projected new demand would use effluent, now that Prescott Valley has acquired the Prescott Valley Water District service area and has initiated delivery of effluent from its wastewater treatment plant to these facilities. New industrial water uses which may develop in the Chino Valley and Dewey-Humboldt areas are assumed to either be picked up by one of the large providers for service, or be insignificant in scale and therefore abstracted into the demand estimates for the two large water providers.

The baseline used to develop the projections is tied to population growth and it is assumed that there is a roughly 50 percent split between industrial water use which falls under the City of Prescott and the Prescott Valley Water District service areas. Although this is not an entirely accurate assumption, the uncertainty of future industrial water trends and the relatively small size in relation to overall AMA water use were factored into this decision in the interest of simplifying the water budgets.

11.3.4 Exempt Wells

The exempt well baseline was obtained by averaging annual water use from 1990 through 1996. New exempt well demand is tied to the projected growth in population described in a previous section and is assigned a consumption rate of 85 GPCD. The population assumptions were derived as part of the municipal sector population projection methodology described under municipal population assumptions listed earlier in this chapter and in Chapter 5.

11.4 PROJECTED SUPPLIES

Water supply factors in the Prescott AMA are estimated for net natural recharge, incidental recharge, effluent, and imported groundwater from the Big Chino Subbasin. These supply factors are then incorporated into various water budget demand scenarios to determine the adequacy of these water supplies to meet demand. Any demand which cannot be met with these supplies is assumed to be met with mined groundwater.

11.4.1 Net Natural Recharge

Net natural recharge is defined as the net naturally occurring additions to groundwater storage. Precipitation is the main source of water replenishing the aquifer as natural recharge. Groundwater conditions in the Prescott AMA are greatly affected by intermittent but occasionally large surface water flows along Granite Creek. Surface water flows recharge the groundwater system as water infiltrates through the stream channel sediments to the underlying aquifer. Mountain front recharge occurs in channels at the margins of mountain ranges. Groundwater exits the Prescott AMA as baseflow, at Del Rio Springs and along the Agua Fria River, and as underflow at Del Rio Springs. The Del Rio Ranch, located on or near Del Rio Springs, diverts an average of 900 acre-feet of base flow annually for irrigation use.

Estimates of natural recharge volumes have been revised since the Second Management Plan based on normalized long-term data for natural inflows and outflows which were derived from Groundwater Modeling Report No. 9 published in 1995. These components are summarized in the overview of water resources discussed in Chapter 2. Based on the 1995 hydrologic report, it is believed that there are no effective groundwater inflows to the Prescott AMA from other adjacent subbasins.

Net natural recharge components were tabulated in Table 3-11 as total natural inflows and natural outflows for the Prescott AMA to demonstrate their impact on water conditions in the Prescott AMA. Table 11-2 illustrates the methodology used to determine an average net natural recharge estimate based on the information from Table 3-11. This estimate was standardized for use in both water budget scenarios.

Accordingly, average net natural recharge in the Prescott AMA from 1990-1997 was estimated at 3,041 acre-feet per year. The combined mountain front and stream channel recharge average in the AMA for this period was 7,891 acre-feet per year. With the exception of the Granite Creek flood recharge, all net natural recharge components are based on average built over a much larger time period. Granite Creek flood recharge estimates are confined to recent observations due to a lack of long-term data. Based on precipitation records, however, the 1990-1996 period was considered to represent a period of wetter conditions than a long-term average would merit.

11.4.2 Incidental Recharge

Incidental recharge is the amount of pumped or diverted water which percolates down to the water table after it is used. In the Prescott AMA, the volume of incidental recharge is largely dependent on the quantity and efficiency of water applications to irrigated land. Effluent, which is artificially recharged, represents water that is legally owned by an individual entity and therefore, cannot be accounted for as contributing to the safe-yield status of the AMA since that party has a right to reclaim that water supply. While total incidental recharge varies somewhat between scenarios due to differences in sector water demand, the percentage rate of incidental recharge for these sectors stays constant across scenarios. These recharge factors are depicted in Table 11-3.

11.4.3 Effluent

Of the estimated 3,200 acre-feet of effluent generated by all wastewater treatment facilities in the Prescott AMA during 1995, approximately 1,100 acre-feet was used directly. The City of Prescott (City) has been recharging roughly 2,000 acre-feet of effluent per year since 1994 pursuant to its Water Storage Permit. Since the City of Prescott has legal possession of these accumulated effluent recharge credits, they cannot be considered available to the Prescott AMA as a whole for determining the AMA's safe-yield status.

TABLE 11-2
COMPONENTS OF NET NATURAL RECHARGE (ACRE-FEET)
PRESCOTT ACTIVE MANAGEMENT AREA

Components	1990	1991	1992	1993	1994	1995	1996	Average
OUTFLOWS								
Del Rio Springs Underflow	-1,500	-1,500	-1,500	-1,500	-1,500	-1,500	-1,500	-1,500
Del Rio Springs Groundwater Discharge	-2,100	-2,100	-2,100	-2,100	-2,100	-2,100	-2,100	-2,100
Agua Fria River Baseflow	-1,250	-1,250	-1,250	-1,250	-1,250	-1,250	-1,250	-1,250
Natural Outflows	-4,850	-4,850	-4,850	-4,850	-4,850	-4,850	-4,850	**-4,850**
INFLOWS								
Agua Fria River Natural Recharge	2,550	2,550	2,550	2,550	2,550	2,550	2,550	2,550
Granite Creek Natural Recharge	2,050	2,050	2,050	2,050	2,050	2,050	2,050	2,050
Granite Creek Flood Recharge	0	0	0	18,720	0	4,320	0	3,291
Natural Inflows	4,600	4,600	4,600	23,320	4,600	8,920	4,600	**7,891**
NET NATURAL RECHARGE	-250	-250	-250	18,470	-250	4,070	-250	3,041

TABLE 11-3
INCIDENTAL RECHARGE ASSUMPTIONS USED IN
THIRD MANAGEMENT PLAN WATER BUDGET SCENARIOS
PRESCOTT ACTIVE MANAGEMENT AREA

Rate Applied To Source Of Recharge	Source of Incidental Recharge
0%	Municipal demand (applies to Prescott AMA and Santa Cruz AMA only; other AMAs get 4%)
25% 50%	Agricultural demand through 2025 assuming 75% agricultural efficiency Canal losses associated with delivery of surface water and effluent to CVID
5%	Industrial demand (non-mining)

Recovered effluent credits, which are projected later in the time line of the Conservation and Augmentation Scenario, are counted against the municipal demand of the City of Prescott. Additionally, Prescott Valley is projected to obtain a water storage permit in this scenario and is assumed to begin recovery of water storage credits once growth surpasses available groundwater supplies that are allocated.

As mentioned previously, 50 percent of new golf courses projected in the Prescott AMA are anticipated to use effluent in the Baseline Scenario, while 100 percent are assumed to develop with effluent in the second scenario.

11.4.4 Imported Groundwater

It is difficult to predict if and when groundwater from the Big Chino Subbasin will be imported into the Prescott AMA by the City of Prescott or any other future municipal providers. The importation will likely be motivated by need. With the declaration that the AMA is not at safe-yield, implementing Assured Water Supply Rules (AWS Rules) requires renewable or imported supplies for new subdivisions. At some point in the future, the existing groundwater allocations and previously approved subdivisions will not be sufficient to support the growth in population. When this occurs, water providers are anticipated to begin recovering water storage credits received for effluent (and possibly surface water) recharged at permitted water storage facilities. Providers may also look at importation for additional supplies and at the possibility of transferring surface water rights from outside the AMA.

11.4.5 Surface Water

Surface water has historically been diverted from Watson Lake and delivered by CVID to water users for irrigation applications. With the recent sale of CVID to the City of Prescott, surface water will be retained at Watson Lake and spillwaters may be recharged through a water storage permit. For projection purposes, however, surface water at Watson Lake is not anticipated to be used directly or recovered through recharge credits prior to the year 2025. The recovery of effluent recharge credits is assumed to take priority.

Other potential surface water supplies are still subject to the adjudications process or are committed for recreational use within the Prescott AMA. Consequently, only the 900 acre-feet of surface water diverted at Del Rio Springs for agricultural use has been included in the water budget scenarios for this chapter.

11.5 RESULTS OF WATER BUDGET ANALYSIS

Two water budget scenarios were selected to illustrate possible water demand and supply scenarios in the Prescott AMA. Projected water budget results through 2025 are shown for these scenarios in Tables 11-4 and 11-5. These scenarios indicate the amount of water conservation and supply augmentation needed to offset future groundwater overdraft. The water budget scenarios do not reflect future water savings that may result from conservation requirements in the Fourth and Fifth Management Plans. The budgets are based on approximate conservation and augmentation goals and are not intended to suggest limitations on individual water users or sectors.

11.5.1 Baseline Scenario Analysis

The Baseline Scenario anticipates that only the City of Prescott will conduct an effluent recharge program and a surface water recharge program. Under this scenario, no groundwater will be imported from the Big Chino groundwater basin before 2025. Groundwater demands increase incrementally until 2025. Renewable supply increases are limited to increased effluent and incidental recharge resulting from the increased groundwater demands. Overdraft increases from 9,331 acre-feet in the baseline to 14,993 acre-feet in 2025.

11.5.2 Conservation and Augmentation Scenario Analysis

Three things contribute to the decrease in overdraft of 9,331 acre-feet in the baseline to 0 acre-feet in 2025 in the Conservation and Augmentation Scenario. These are: (1) meeting Third Management Plan targets for municipal water use, (2) reduced groundwater use by turf facilities due to meeting Third Management Plan targets and incentives for effluent use, and (3) the importation of Big Chino groundwater. In this scenario, groundwater use decreases by about 8,819 acre-feet by 2025 as compared to Scenario 1, almost all of which is offset by imported groundwater, recovered effluent and surface credits, and incidental recharge.

TABLE 11-4
BASELINE SCENARIO (ACRE-FEET)
PRESCOTT ACTIVE MANAGEMENT AREA

	Baseline	2000	2005	2010	2015	2020	2025
Municipal Demand	10,300	11,100	12,900	14,700	16,600	18,400	20,100
Municipal Effluent Demand	900	1,600	1,900	2,100	2,400	2,600	2,800
Agricultural Demand	6,800	4,400	3,500	4,100	4,100	4,100	4,100
Agricultural Effluent Demand	0	1,500	1,500	0	0	0	0
Industrial Demand	700	300	300	200	300	300	300
Exempt Well Demand	1,100	1,200	1,300	1,300	1,400	1,400	1,500
Total Demand	**18,900**	**19,200**	**20,500**	**21,500**	**23,900**	**25,900**	**27,900**
Net Natural Recharge	3,041	3,041	3,041	3,041	3,041	3,041	3,041
Incidental Recharge	1,735	1,520	1,300	1,080	1,090	1,095	1,100
City of Prescott Effluent	900	1,000	1,200	1,300	1,400	1,500	1,600
Prescott Valley Effluent	0	0	0	0	0	0	0
Recovered Effluent Credits	2,993	1,532	1,824	3,749	4,173	4,490	4,826
Recovered Surface Credits	0	1,500	1,500	1,500	1,500	1,500	1,500
Agricultural Surface Water	900	900	900	900	900	900	900
Renewable Supplies	**9,569**	**9,493**	**9,765**	**11,570**	**12,104**	**12,526**	**12,967**
Water Balance (Groundwater Overdraft)	-9,331	-9,707	-10,735	-9,930	-11,796	-13,374	-14,933
Imported Groundwater	0	0	0	0	0	0	0
Final Water Balance (Groundwater Overdraft)	**-9,331**	**-9,707**	**-10,735**	**-9,930**	**-11,796**	**-13,374**	**-14,933**

11.6 ANALYSIS AND DISCUSSION

11.6.1 Comparison to Previous Water Budgets

The Second Management Plan presented water demand and supply conditions for two scenarios. Base conditions in 1985 served as the foundation for both budgets, with modifications to account for population increases and a reduction in irrigated acreage. The first scenario incorporated Second Management Plan program conservation goals and full use of existing Central Arizona Project (CAP) allocations into the projections. In the second scenario, base water supply and demand conditions were assumed to continue through 2025 without conservation or CAP water use.

TABLE 11-5
CONSERVATION AND AUGMENTATION SCENARIO (ACRE-FEET)
PRESCOTT ACTIVE MANAGEMENT AREA

	Baseline	2000	2005	2010	2015	2020	2025
Municipal Demand	10,300	11,100	12,900	14,700	16,600	18,400	20,100
Municipal Effluent Demand	900	1,600	1,900	2,100	2,400	2,600	2,800
Agricultural Demand	6,800	4,400	3,500	4,100	4,100	4,100	4,100
Agricultural Effluent Demand	0	1,500	1,500	0	0	0	0
Industrial Demand	700	300	300	200	300	300	300
Exempt Well Demand	1,100	1,200	1,300	1,300	1,400	1,400	1,500
Total Demand	**18,900**	**19,200**	**20,500**	**21,500**	**23,900**	**25,900**	**27,900**
Net Natural Recharge	3,041	3,041	3,041	3,041	3,041	3,041	3,041
Incidental Recharge	1,735	1,490	1,265	1,035	1,040	1,040	1,040
City of Prescott Effluent	900	1,000	1,200	1,300	1,400	1,500	1,600
Prescott Valley Effluent	0	600	700	900	1,000	1,100	1,200
Recovered Effluent Credits	2,993	1,532	4,580	6,980	7,920	8,920	9,800
Recovered Surface Credits	0	1,500	1,500	1,500	1,500	1,500	1,500
Agricultural Surface Water	900	900	900	900	900	900	900
Renewable Supplies	**9,569**	**10,063**	**13,186**	**15,656**	**16,801**	**18,001**	**19,081**
Water Balance (Groundwater Overdraft)	-9,331	-9,137	-7,314	-5,844	-7,099	-7,899	-8,819
Imported Groundwater	0	0	0	5,844	7,099	7,899	8,819
Final Water Balance (Groundwater Overdraft)	**-9,331**	**-9,137**	**-7,314**	**0**	**0**	**0**	**0**

Municipal, industrial, and agriculture use projections have been changed in the Third Management Plan water budgets to reflect current information and revised conservation requirements. Major differences between the water budget projection used in the Second Management Plan document and in the current water budget scenarios include the substitution of Big Chino groundwater for CAP water in the Conservation and Augmentation Scenario, less projected agricultural demand, adjusted net natural recharge, and absence of surface water inflows. These changes are briefly described below.

Since the Second Management Plan, all owners of CAP allocations in the Prescott AMA have sold their CAP contracts to the City of Scottsdale. It was assumed that the CAP proceeds would be used to find other water supplies to support municipal demand, through either the importation of Big Chino groundwater or the purchase of CVID surface water rights.

Agricultural activity in the Prescott AMA has declined more than was forecasted in the Second Management Plan water budgets. This has coincided with faster than anticipated growth in the municipal sector, as the Prescott AMA population has exceeded earlier predictions. As a result of this trend, the Third Management Plan scenarios reflect a continuation of this trend as agricultural lands gradually are converted to support residential and commercial growth.

Surface water flow diversions at Del Rio Springs of 900 acre-feet per year for agricultural demand have been added to the Third Management Plan water budgets. Baseflow at Del Rio Springs, leaving the Prescott AMA and flowing into the Verde River near Paulden, has been set at 1,200 acre-feet per year. These figures are shown in Table 11-4.

Net natural recharge estimates have been revised from earlier estimates in the Second Management Plan based on recent computer modeling results and the deduction of some natural recharge from Granite Creek due to diversions of surface flows to the CVID.

11.6.2 Results of Sensitivity Analysis

Sensitivity analyses were performed on several variables to determine the relative magnitude of impacts of individual water budget factors on overdraft levels. The variations shown in the sensitivity analyses do not constitute projections. Municipal, industrial, and agricultural variables were adjusted to 110 percent of their current projections and to 90 percent of their current projections in order to determine the relative impact these adjustments had on overdraft. These variables were:

- Population growth rates
- Municipal GPCD water use rates
- Agricultural cropped acreage ratios
- Industrial water demand

11.6.3 Safe-Yield Concepts

Safe-yield is an AMA-wide balance between groundwater inputs and withdrawals on an annual basis. This includes water which is added to the groundwater system through natural or incidental recharge and water which is withdrawn from the system by natural factors and by pumpage for municipal, agricultural, and industrial uses.

The Groundwater Management Act mandates that the AMA achieve safe-yield by 2025. Once safe-yield is achieved, maintenance of this balance will require continued vigilance because population and associated demands on the water supply will continue to grow.

Because the water table is greatly effected by localized recharge and withdrawal, achieving safe-yield AMA-wide does not ensure that all subareas of the AMA will attain a balance of supply and demand. There may be areas within the AMA where localized groundwater declines cause subsidence, dried-up wells, increased pumping costs, and water quality changes. Conversely, the benefits of recharge may be confined to areas where recharge basins and stream channels are located. Addressing the impacts of local water level declines and recoveries in subareas of the AMA is a critical issue for water management as the Third Management Plan proceeds. A more comprehensive approach to defining water level balance needs to be designed and implemented to ensure that all areas of the AMA receive the benefits of a stable water level.

11.6.4 Determining Factors

Only a portion of the water management factors which affect the AMA's ability to achieve safe-yield are under the control of the Department as mandated in the Groundwater Management Act. These include conservation requirements, assured water supply designations, permitting recharge facilities, well permitting, and incentives for use of renewable supply.

Many more water management factors are not under the control of the Department and may be hard to predict. The outcome of these variables could either impede or enhance the AMA's ability to reach safe-yield.

Economic and growth factors which can impact water supply and demand revolve around water pricing for groundwater that is controlled by water providers and the Arizona Corporation Commission. Pricing can have a direct effect on the level of groundwater use. Energy costs affect water pricing to some extent as well. Economic conditions can have positive or negative effects on water demand. Population growth can lead to retirement of agricultural land to make room for housing, but increased growth can also result in higher water demand for support industries and increased municipal demand.

11.7 CONCLUSIONS

The last decade has seen rapid changes in water resources management strategies in the Prescott AMA. As the Department has gathered more hydrologic data for the Prescott AMA, assumptions about groundwater conditions in the AMA have changed. The Third Management Plan water budgets presented here indicate that the AMA must expand its efforts to use renewable water supplies while also looking for ways to import groundwater from the Big Chino Subbasin if it is to ensure safe-yield conditions by 2025. Once safe-yield is reached, however, remaining at safe-yield will be an ongoing challenge. Carrying projections beyond 2025 is problematic because of the number of uncertainties we face, but it is an important exercise in understanding the long-term limitations the AMA faces in terms of water supply.

The computer model is an equally important tool in coming face-to-face with the possible impacts of water level declines and subsidence. The major challenges of water management in the desert has required creative, innovative solutions, attributes which Arizona communities and state government have successfully used in the past. These attributes will continue to be important as we face a future of population growth, Colorado River shortages, and intensifying competition for Arizona's limited water resources.

REFERENCES

Corkhill, E.F. and Mason, D.A. 1995. *Hydrogeology and Simulation of Groundwater Flow. Prescott Active Management Area, Yavapai County, Arizona* (Report No. 9).